

If you're teaching a difficult concept in class, build short (graded or ungraded) formative assessments into class time that act as formative assessments for you and your students.

The problem:

- a. It is hard for you to tell if students understand material if you are just talking at them
- b. It is hard for students to tell if they understand the material if they don't have a chance to think about it or apply it while it's being presented

My example:

Context and problem: In a large Geology 101 lecture, students were not understanding graphs, and especially a graph that can be used to illustrate how magma forms in different temperature/pressure conditions.

My (impromptu) fix: (a) I began by asking students, "You know that increasing the temperature of something can cause it to melt. How else can you melt something?" (b) I talk students through drawing the graph in their notes and discuss axis labels and the "liquid-solid" line. (c) I ask them to figure out which side of the line would be "solid" and which "liquid," (d) where the Earth's exterior would be on the graph, and (e) how they could cause melting from different starting points.

What I discovered:

- (a) Misconception: students thought increasing pressure caused rock to melt
- (b) Students did not understand what the graph was representing (even without data on the graph)
- (c) Before students had been labelling their graph to match what was on the slide (rather than because they understood why one side represented solid and one represented liquid)
- (d) Students were not able to connect points on the graph to actual locations (e.g., crust vs mantle)
- (e) Students could use the graph to figure out how to melt a rock at a given location *once they understood what the graph was showing them/how to read the graph*

My solution:

1. *Give students processing time in class.*
 - a. If you're talking the whole time, students are busy listening and not necessarily thinking
 - b. You don't need to have an "active learning" activity planned, just create natural pauses around difficult concepts
2. *Give students a task to try out their skills*
 - a. Have a directed, but open-ended question (written prompt is good but not required)
 - b. Group accountability: have students report out to each other or the class
 - c. Wander around the room and listen in!
3. *Benefits:*
 - a. If students have processing time and formative assessments, they'll better recognize when they don't understand something
 - b. If you know where students are struggling, it will be easier to develop scaffolds for learning
4. *What to do with knowledge you obtain in formative assessment:*
 - a. Once problem areas are recognized, develop a more formal in-class or homework activity that scaffolds learning (I'm still working on this!)

In YOUR class

What is one concept that student routinely have difficulty digesting/understanding in your class?

How could you break this concept down into simpler steps, OR turn some of the content around so that the students have to process the information themselves?

Some research/resources:

Biggs, J.B., 1989. Approaches to the Enhancement of Tertiary Teaching, Higher Education Research and Development 8(1), 7-25, DOI: 10.1080.0729436890090102

Winstone, N., and L. Millward, 2012. Reframing perceptions of the lecture from challenges to opportunities: Embedding active learning and formative assessment into the teaching of large classes. Psychology Teaching Review 18(2), 31-41.

Figure 1 shows Earth, the Sun, and five different possible positions for the Moon during one full orbit (dotted line). It is important to recall that one-half of the Moon's surface is illuminated by sunlight at all times. For each of the five positions of the Moon shown below, the Moon has been shaded on one side to indicate the half of the Moon's surface that is **not** being illuminated by sunlight. Note that this drawing is not to scale.

- 1) Which Moon position (A–E) best corresponds with the Moon phase shown in the upper-right corner of Figure 1? Make sure that the Moon position you choose correctly predicts a Moon phase in which only a small crescent of light on the left-hand side of the Moon is visible from Earth.

Enter the letter of your choice: _____

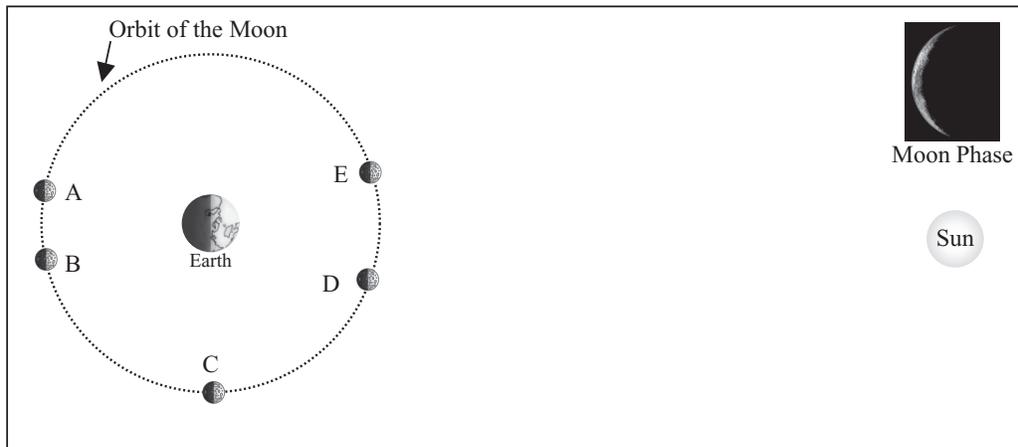


Figure 1

- 2) In the blank boxes below, sketch how the Moon would appear from Earth for the four Moon positions that you did **not** choose in Question 1. Be sure to label each sketch with the corresponding letter indicating the Moon's position from Figure 1.

| | |
|--|--|
| | |
| | |

The Cause of Moon Phases

- 3) Shade in each of the four Moons shown in Figure 2 to indicate which portion of the Moon's surface will **not** be illuminated by sunlight.

Use Figure 2 to answer Questions 4–7.

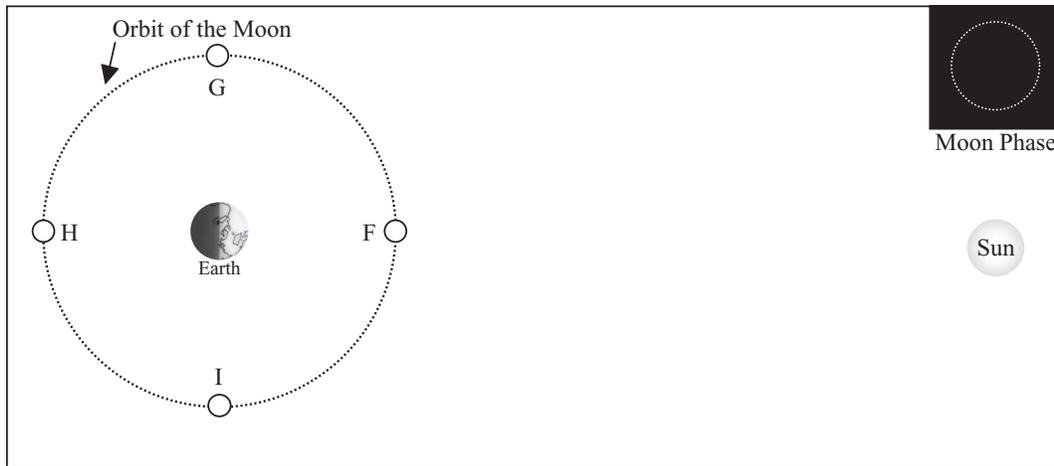


Figure 2

- 4) Which Moon position (F–I) best corresponds with the Moon phase shown in the upper-right corner of Figure 2?

Enter the letter of your choice: _____

- 5) How much of the entire Moon's surface is illuminated by the Sun during this phase (*circle one*)?
- None of the surface is illuminated.
 - Less than half of the surface is illuminated.
 - Half of the surface is illuminated.
 - More than half of the surface is illuminated.
 - All of the surface is illuminated.
- 6) How much of the Moon's illuminated surface is visible from Earth for this phase of the Moon (*circle one*)?
- None of the surface (visible from Earth) is illuminated.
 - Less than half of the surface (visible from Earth) is illuminated.
 - Half of the surface (visible from Earth) is illuminated.
 - More than half of the surface (visible from Earth) is illuminated.
 - All of the surface (visible from Earth) is illuminated.

- 7) Would your answers to Questions 5 or 6 change if the Moon were in the third-quarter phase rather than the phase shown in Figure 2? Explain your reasoning.

- 8) Consider the following discussion between two students about the cause of the phases of the Moon.

Student 1: *The phase of the Moon depends on how the Moon, Sun, and Earth are aligned with one another. During some alignments only a small portion of the Moon's surface will receive light from the Sun, in which case we would see a crescent Moon.*

Student 2: *I disagree. The Moon would always get the same amount of sunlight; it's just that in some alignments Earth casts a larger shadow on the Moon. That's why the Moon isn't always a full Moon.*

Do you agree or disagree with either or both of the students? Explain your reasoning.

Communication Simulation using Dominoes

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Halbach, J. L. & Sullivan, L. (2002) Medical Errors and Patient Safety: A Curriculum Guide for Teaching Medical Students and Family Practice Residents. New York Medical College
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